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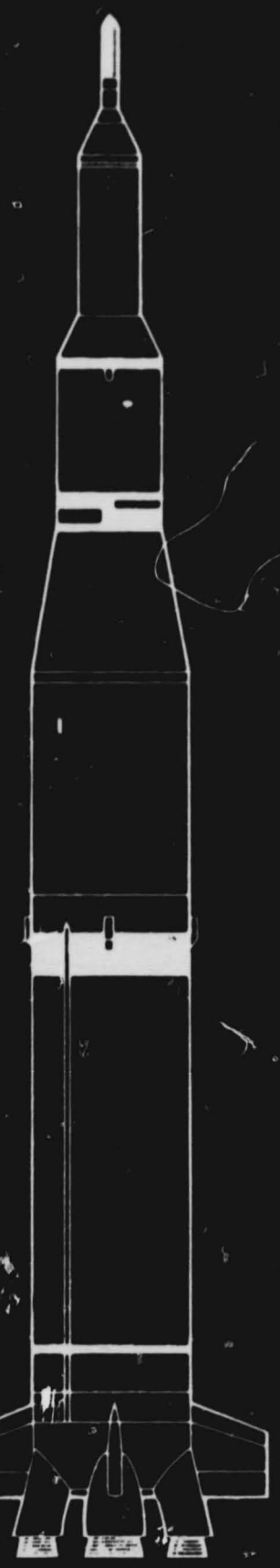

NASA National Aeronautics and Space Administration

Syracuse University

THIRD SEMI-ANNUAL REPORT
SYRACUSE/NASA PROGRAM
for the period
January 1, 1969 - June 30, 1969

MULTIDISCIPLINARY STUDIES IN MANAGEMENT AND DEVELOPMENT PROGRAMS IN THE PUBLIC SECTOR

Grant No. NGL 33-022-090

SYRACUSE UNIVERSITY

October 1969

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I. INTRODUCTION AND ADMINISTRATION

Four major interdisciplinary research projects, several smaller research activities, and an education and training program for graduate students are presently being conducted at Syracuse University as a result of the association between the University and the National Aeronautics and Space Administration. The research and educational activity carried out under the Syracuse/NASA Program during this reporting period involved twenty faculty members and eighteen graduate students from the Maxwell School, and the Colleges of Engineering, Law, Business and Journalism.

The University-wide Program falls under the jurisdiction of the University Vice President for Research and Governmental Affairs. A committee of the Deans of the four participating schools and colleges maintained general cognizance over the Program, being kept informed by the Program Directors and individual project directors.

The Syracuse University Research Institute and the University's Research Accounting Office provide administrative and financial controls for the Program. Headquarters of the NASA Program is located at 133 Stadium Place, adjacent to the campus, where offices, a conference and reading room are provided.

During the report period Dr. John C. Honey, who had been Program Director, accepted the position of Vice President, Research and Governmental Affairs. Professor Martin E. Barzelay of the Mechanical and Aerospace Engineering Department and Professor Edwin A. Bock of the Department of Political Science were named Co-Directors of the Syracuse/NASA Program. Professor Barzelay undertook primary responsibility as principal investigator of the grant and Professor Bock primary responsibility for the associated traineeship activities. Professor Barzelay also continued his activities in connection with the research on the Role of the Project Manager, with much of the substantive direction turned over to Professors Wood and Wilemon.

Project Directors for the four major research efforts were:

Role of the Project Manager - Professor David Wilemon (College of Business) and Professor Bernard Wood (College of Engineering).

NASA/Business Relations - Professors Peter G. Franck and E. Bruce Fredrikson (College of Business).

Regulations in Space - Professor George J. Alexander (College of Law).

Case Studies - Professor Edwin A. Bock (Maxwell School).

During this reporting period, members of the four major project teams and others made field trips to NASA Headquarters, NASA field centers, tracking stations both in the U.S. and abroad, universities and private corporations. Extensive research on the major and smaller projects was accomplished. Working papers and preliminary reports were written by faculty and graduate students and papers were delivered at several conferences. A graduate-level seminar on Science and Public Policy was offered and the University-wide NASA Seminar series continued with monthly meetings.

In April, Professors Honey, Barzelay, Wilemon, Hopeman, Wood and Marini attended the NASA Conference on Interdisciplinary Research at Kennedy Space Center.

II. MAJOR PROJECT RESEARCH

A. ROLE OF THE PROJECT MANAGER

During the past six months, the interdisciplinary research team investigating the Role of the Project Manager in the Apollo program has made substantial progress in accomplishing the original objectives of the research task. The reporting period also can be characterized as one where significant amounts of field research were undertaken and where concentrated efforts were made to assimilate and find meaningful patterns to the research findings.

In the following sections, a brief review of each of the field trips undertaken in the reporting period will be made. Following the field trip reviews, another section covers the research reporting via working papers and occasional papers. Progress being accomplished by the graduate students in their dissertations and theses is also reported. In the final section, the report includes a discussion of other related activities of various project team members.

The research team consists of the following individuals:

Henry Anna (Doctoral Candidate) Political Science
Martin Barzelay (Professor) Mech. and Aerospace Engineering
John Cicero (Doctoral Candidate) Business Administration
Eugene Drucker (Professor) Mechanical and Aerospace Engineering
George Frederickson (Assistant Professor) Political Science
Richard Hopeman (Associate Professor) Business Administration
Barry Kelmachter (Graduate Student) Mech. and Aerospace Engineering
William Pooler (Assistant Professor) Sociology
Alphonse Sallett (Doctoral Candidate) Sociology
Kin Tong (Professor) Mechanical and Aerospace Engineering
David Wilemon (Assistant Professor) Business Administration
Bernard Wood (Professor) Mechanical and Aerospace Engineering

1. Trips by Research Participants to Interview NASA Personnel and Others

Data gathering in this period has been largely through personal interviews at various locations with NASA personnel and contractors' representa-

tives. As in the past, two or more research participants traveled together. Wherever possible, more than one was present at each interview, and an attempt was made to have various disciplines represented among the interviewers. With the permission of the men being interviewed (and most did grant permission), the interviews were tape-recorded so that transcripts could be made available to all members of this research group. As soon as possible, typed transcriptions have been returned to interviewees for their corrections and comments.

The most willing and obliging cooperation of staff personnel at Headquarters and at the centers contributed immeasurably in the arrangement of useful interviews and efficient time schedules. For the sake of brevity, there will be no attempt to list the dozens of individuals interviewed, and the research participants will be referred to by surname only in the following paragraphs.

On January 2-8, 1969, Hopeman, Wilemon and Lasher visited NASA Headquarters primarily to interview various individuals in the Apollo Program Office and in certain support function offices there. During this visit, there was an opportunity to observe the operation of NASA's Management Council and NASA's Design Change Review Procedures.

A second trip to Headquarters on January 23-24, was made by Wilemon and Cicero. The purpose was primarily to learn more about the Executive Assignment System, which contains information on managers above GS-15, and NASA's Personnel Management Information System (PMIS).

Five members of this group visited MSFC, Huntsville, together February 5-7. To obtain as broad coverage as possible, the group split into two sections for the most part. Fredrickson and Anna concentrated their efforts on interviewing project and stage managers, while Wilemon, Wood and Cicero interviewed more sub-system managers in Industrial Operations from the Saturn Program Office and the Engine Program Office. In addition, personnel from the Apollo Applications Program and from Project Logistics were sought out because they had not been covered previously.

In the period March 10-12, members of the Project Management Study group visited MSC, Houston, for the second time. Drucker, Frederickson,

Anna and Kelmachter, either in pairs or as a group, conducted 16 separate interviews. The interviewees were managers from the Apollo Program Office, some sub-system managers in the Engineering and Development Directorate, and one project manager from the Science and Applications Directorate. There was a concerted effort made at this time to obtain the names of people at contractors' plants for future interviews. Because Frederickson from S.U. was a personal friend of the astronaut, Dr. Don Lind the group was able to discuss with Dr. Lind some of the responsibilities and views of the astronauts.

A fourth visit by members of this study group to MSFC, Huntsville, was made in the period March 25-28. Wilemon, Wood and Cicero made an effort to interview as many men as possible in the Research and Development Operations side of MSFC, following leads from previous interviews in Industrial Operations; Wilemon and Cicero were able to see a few managers in the IO side as well. Anna and Kelmachter concentrated their efforts in the Apollo Applications Program offices to broaden the group's perspective beyond Apollo and to see a program in an earlier phase. Also, some of the AAP managers had come from the Saturn 1 and 1B Programs and provided useful insights. The whole group was very fortunate in being able to conduct an extended interview with Dr. Arthur Rudolph, former Saturn V program manager, whose perspectives on the development of project management were extremely interesting and useful.

Frederickson and Anna visited NASA Headquarters on three occasions: April 24-25, May 1-2, and May 8-9. On these trips, some 16 NASA personnel primarily from the Apollo Program Office were interviewed. In addition, three members of the House of Representatives Committee on Science and Astronautics were interviewed. All these interviews were useful in obtaining high-level perceptions of program and project management and a broad view of the program environment.

On May 15, Frederickson and Anna were joined by Kelmachter for an interview with Mr. James Webb at the National Academy of Public Administration (NAPA), Washington. Mr. Webb, former NASA Administrator, spoke primarily about project management and its development in NASA and about some

of the significant events during his administration. The opportunity for this interview, the transcript of which has gone to all members of the group, has been invaluable in providing background for this investigation and some appreciation of the reasons for certain developments.

A visit to NASA Headquarters on June 5 was made by Pooler and Sallett primarily to begin a more thorough search at Headquarters for historical information relevant to this study. There were discussions with Dr. Eugene Emme of the NASA Historical Office, Mr. William Putnam, official Apollo historian, and Mr. Charles Bingman.

Grumman Aircraft Engineering Corporation at Bethpage, New York, was visited June 12-13 by Drucker and Kelmachter. This was the first formal visit to a major NASA contractor. It was possible to interview Grumman's top management for the LM Program, and to talk informally with the manager and assistant manager of the Resident Apollo Spacecraft Program Office (RASPO). Discussions were mainly about Grumman-NASA contacts, the resolution of conflicts, project management at Grumman, and differences in management between that company and NASA. A follow-up trip to Grumman is planned for the near future as well as one to North American Rockwell's Space Division at Downey, California.

2. Research Reporting and Dissemination

As in the last reporting period, a number of working papers and occasional papers were written on the research conducted.

Working Papers

(a) "A Concept of Project Authority," 6223-WP-6, John P. Cicero, March, 1969, The main objective of this paper is to define some methodology of physical procedure for examining an operational authority construct in an organization like the NASA. The organization chart, job descriptions, and formal policy statements are examined in detail in order to focus on the formal authority base of the project manager. Interview data and questionnaire data are then analyzed to help focus on the informal authority base of the project manager. The ultimate resolution of where the PM's authority comes from is not decided here. However, a substantial case is made in the

direction of informal authority and/or influence as the base of the PM's authority.

(b) "A Concept of Project Authority in the NASA/Apollo Programmatic Environment," 6223-WP-7, John P. Cicero and David L. Wilemon, June, 1969. This paper covers a broad spectrum of authority constructs, both theoretical and observational as evidenced by our research within NASA. The paper first defines some basic authority relationships and then moves toward an overview of project management authority. Models of project management and the project manager's uses of authority and influence are discussed.

The remainder of the paper focuses on the NASA programmatic environment and how an authority construct might be operationally defined within the NASA. The final pages look to some comments made by Apollo participants in order to further clarify an authority construct applicable to the NASA.

(c) "NASA and the Apollo Program," 6223-WP-8, William Pooler and Alphonse Sallett, July, 1969. This paper focuses on the organizational dimensions of NASA's history. The paper attempts to identify some of the factors involved in the creation of NASA, the major organizational changes since 1958, the basic reasons why these changes were made and the consequences of these changes through time. More specifically, the paper outlines the changing relationships between top management, the program directors and the field center directors with special concern for the relationship between: top management and the rest of the organization; top management and the Apollo program; and the Apollo program and the rest of the organization. Finally, the paper notes a trend toward the investiture of greater degrees of formal power and authority in the hands of top management as well as attempts by top management to standardize, integrate and control all major policies, procedures, resources and programs in terms of a NASA-wide point of view.

(d) "Project Management: A New Dimension in Complex Task Management," 6223-WP-9, David L. Wilemon, July, 1969. The objective of this paper is to present an overview of the project management concept as it is most commonly practiced in government and industry. It emphasizes the point that project

management is a relatively new philosophy and is an alternative to traditional methods of management and organizational design. Key points covered in the paper are: 1) The rationale of project management; 2) Definitions of key project management concepts; 3) Criteria for establishing a project management organization, 4) The institutional/functional/programmatic interfaces; 5) Models of project management organization; and 6) An examination of the managerial strategies used in programmatic environment.

An effort is made throughout the paper to present the primary structural aspects of project organizations, the mechanical side of organizing for it, as well as the behavioral problems inherent in a project system.

(e) "The NASA Scheduling System" (Scheduling in the Apollo Program), 6223-WP-10, R. J. Hopeman, July, 1969. (Working Papers 11-15 are being written by Professor Hopeman). This paper is an overview of the NASA approach to scheduling. It covers aggregate scheduling involving major phasing of the Apollo program through mission schedules, launch schedules, project management schedules, to the detailed scheduling of hardware end-items. It is the first such paper dealing with systems management in the Apollo Program.

(f) "Project Management at Houston," 6223-WP-16, Henry J. Anna, May, 1969. This paper is an attempt to trace out how project management is handled at MSC and to compare this to what was known about MSFC at that time. The paper discusses where and how technical decisions and trade-offs are made, the relations between the Program Manager and the "hardware managers", change control procedure, System Engineering and Project Engineering, subsystems managers and the relationships between the ASPO and the Directorate for Engineering and Development, and hardware development projects outside of ASPO. The conclusions are related to relations between the ASPO and MSC, the dual nature of MSC as a development and operational field center, the Program and Project orientations and the personalized character of the total Apollo organization. This paper is being revised and the revised version will be circulated at a later date.

(g) "The Apollo Project Manager: Anomalies and Ambiguities," 6223-WP-17, David L. Wilemon and John P. Cicero, June, 1969. This paper deals with some of the problems that the Apollo project managers face in

the everyday operation and implementation of the manned space effort. The emphasis is on the focal position of the project manager rather than on an overall systems concept of project management. Five areas of ambiguity in terms of problem resolution and management strategies are discussed: (1) maintaining the balance between technical and managerial emphasis; (2) risk acceptance/rejection; (3) surviving organizational systems; (4) the necessity of project communication; and (5) penetrating organizational systems. Discussion of these areas gives some preliminary insights into the management styles of the effective project manager and opens diverse areas for future research on the management of large-scale, complex undertakings such as Apollo.

(h) "Project Authority: A Multidimensional View," 6223-WP-18, John P. Cicero and David L. Wilemon, June, 1969. This paper delineates some basic authority relationships within five models of project management; (1) the individual model, (2) the staff model, (3) the intermix model, (4) the aggregate model, and (5) the NASA Apollo model. The authority construct is broken down into formal authority (authority inherent with the position and organizationally derived) and functional authority (authority generated by the individual through his own competence and human administrative skills).

The focus of the paper shows how the bases and functions of authority tend to shift within the various models of project management. An examination of the project manager's use of restrictive authority and influence in varying project contexts eliminates some of the ambiguity surrounding the concept of project authority by clearly presenting the alternatives open to the project manager.

(i) "Relationships Between the Research and Development Operations and Industrial Operations at MSFC," 6223-WP-19, Bernard D. Wood. Presented at an Interdisciplinary Seminar, Continuing Education Center, Syracuse University, April 16, 1969. There was an attempt through this paper to explain to all SU/NASA research participants the complex relationships, both formal and informal, between the two directorates (R&DO and IO) at the Marshall Space Flight Center as they existed prior to the reorganization of February, 1969. Through a detailed expansion of selected sections of the official organization chart, a typical interaction between a sub-system manager in

IO and a particular section of one laboratory in R&DO was examined.

The formal channels, the management matrices and the modes of informal contact were reviewed as seen from the perspective of our numerous interviews at that center. In addition, the Change Board and the management "levels" throughout the Apollo program were examined.

(a) "A Project Management Approach to Interdisciplinary Research in Universities," 6223-OP-2, R. J. Hopeman and D. L. Wilemon, April, 1969. (Revised 6/9/69) (Presented at KSC, April 24, 1969, Conference on Interdisciplinary Research.) The objective of this paper is to explore the problems and prospects of encouraging meaningful interdisciplinary research in universities and to suggest how a project management approach can be applied. The ideas presented are based on the author's current experience with a grant from NASA to investigate the role of the project manager and management systems within the Apollo program. Additionally, some of the thoughts are derived from an "ideal construct" of what interdisciplinary research should encompass. It may be questionable whether all of the recommendations can be immediately implemented in university research programs, however, the authors believe that the pursuit of them is a meaningful and challenging objective. Several specific recommendations are given for managing interdisciplinary research in universities.

(b) "Interdisciplinary Research in a University," 6223-OP-3, Bernard D. Wood. (Presented at KSC, April 24, 1969, Conference on Interdisciplinary Research.) This paper presented the views of the author resulting from his association with the Project Management Study group at Syracuse and some twenty years of observing attempts at group research in a university environment. Four main points were developed concerning ID research at a university:

-- It is important because it is natural to the true university; it is necessary for significant contributions in some fields; it is rewarding to the individual and to the institution.

-- ID research is impeded by the conventional university administrative organizational form and by the narrowly conceived professional goals of individual faculty members.

-- ID research is more difficult than individual research because it requires group cooperation and tighter planning and operating procedures.

-- ID research should be undertaken only by those with a commitment to the specific project goals and the spirit of ID research itself.

(c) "Managing Product Development Systems: A Project Management Approach," 6223-OP-4, David Wilemon, July, 1969. In an effort to look at alternative uses for project management techniques this paper suggests that project management has potential value in managing a "total" product system in industry--especially by those firms manufacturing technical products. Rather than viewing the functions of new product research and development and product commercialization as distinct managerial activities, the paper suggests that project management is a potentially useful mechanism that can integrate both the R & D and product commercialization processes. It is suggested that the proposed management approach will aid in mobilizing the organizational resources necessary for an efficient and effective product development system.

(d) "Bureaucracy and the Urban Poor," 6223-OP-5, H. George Frederickson and Henry J. Anna, March, 1969. This paper examines the relationship between widespread personal poverty and bureaucratic public administration in urban America. The urban poor are characterized by a distinct set of socio-emotional traits and constitute a peculiar and special kind of clientele for the organizations with which they interact. Bureaucracies are specialized, hierarchical, impersonal and slow. But the poor have immediate needs, and these needs are interrelated, not specialized. The paper examines alternatives to bureaucratic organizations which might prove more effective in meeting the needs of the urban poor. The first is a religiously based service or welfare organization which considers the client's needs as a whole. This approach is limited by its religious base and small size. The second alternative is the proposed application of project management at the community or client level. This approach seems to open the possibility of coordinated, systematic service to solve the problems of urban poverty on a personal level. This paper is currently being revised and the revised version will be circulated at a later date.

3. Development of Dissertation and Thesis Topics

During the reporting period significant progress continued to be made on the development of dissertation and thesis topics some of which are to be submitted to the Graduate School within the next few months.

(a) Non-Hierarchical Public Management: A Study of Scientific and Technological Programs, Henry J. Anna (Political Science). This dissertation will examine the organizational structure and relations to the total organization of the Apollo Program hardware research and development projects. It will employ a refined model of matrix theory to relate the workings of the project groups to selected characteristics of their personnel and their tasks. This, in turn, will be used to relate the project organization to a general theory of organization. The study will particularly focus on the relations between the project groups and the rest of the NASA organization. The data for the study was gathered in interviews with project managers, subsystems managers and related personnel at MSC and MSFC and Apollo Program and other NASA personnel at Headquarters.

(b) The Technical and Professional Qualifications of Apollo Project Managers, John P. Cicero (Business Administration). This thesis concerns itself with defining what the professional and technical qualifications of a project manager are if the office of project manager is viewed as a career objective in the same sense as "doctor" or "lawyer" or "engineer". The paper focuses on the demographic characteristics of a select group of Apollo Project Managers. From the demographic profile which emphasizes job experience and job-related qualifications, an attempt will be made to interpret all professional and technical qualifications as displayed by the sample. This, hopefully, will add the objective dimensions of research to current thought on what characteristics "should" be displayed by successful project managers.

(c) The Training and Preparation of NASA Project Managers, Barry L. Kelmachter (Aerospace Engineering). The purpose of this thesis is to examine the ways in which an engineer is turned into a project manager. Of primary interest is the types of backgrounds in terms of education, work experience, and age that various project managers possess. It is hoped

that enough data can be gathered that a comparison between the training and preparation of NASA project managers and the training and preparation of industrial project managers holding similar jobs (NASA counterparts) can be made. In addition, the project manager's perceptions of what project management is, what his function as a project manager is, what type of problems he faces, and some suggestions toward a curriculum development will be part of this thesis.

(d) The Consequences of Project Management Organization for the Apollo Program: A Comparative Study, Alphonse Sallett (Sociology). This dissertation will be concerned with the routinized social meanings that develop in specific projects within large organizations and the consequences this has for the maintenance of the projects through time, from the perspective of both the larger organization and the members of the projects themselves. The selection of two projects is proposed, one at Huntsville and one at Houston, for a comparative study. The dissertation is an integral part of the larger study of Pooler and Sallett.

4. Other Project Team Activities

Several additional project related activities were accomplished by members of the interdisciplinary team during the last six months.

Professor Hopeman developed two seminars in the management systems areas. In each seminar NASA films and concepts were incorporated. One of the highlights of Professor Hopeman's seminars was a visit by Mr. Robert A. Smith, III, of MSFC, who spoke on managing complex organizations and project management. During this period discussions were initiated toward providing a practitioner in residence position for Mr. Smith. Professor Hopeman also made several talks to managers from the U.S. and abroad on systems concepts derived from the Apollo Program. A new book titled Systems Analysis and Operations Management has been published. These seminars and his book were not funded by NASA.

Three members of the project management research group were invited to give papers at the Kennedy Space Center in April on interdisciplinary research in Universities. Professors Hopeman and Wilemon jointly presented a paper titled "A Project Management Approach to Interdisciplinary Research

in a University," (see 6223-OP-2). Professor Wood's paper, "Interdisciplinary Research in a University," is 6223-OP-3. Both papers gave rather diverse approaches to achieving interdisciplinary research within universities.

In March, Professor Wilemon delivered a talk to the Syracuse/NASA seminar on project management. His discussion presented an overview of project management; the differences between project management and traditional approaches to management; and a discussion on the various methods of organizing for project management.

In April, four members of the project management research team made a presentation to an Interdisciplinary Seminar at Syracuse University's Continuing Education Center on specific insights and research findings in the Apollo project manager as a unique type of manager. Professor Pooler discussed the historical evolution of the Apollo Program and NASA's institutional structure. Professor Wilemon based his discussions on the various managerial strategies utilized in a programmatic environment. The Research and Development Organization's interface with MSFC Industrial Operations Organization was discussed by Professor Wood.

Concurrent with the above activities an intensive review of NASA publications and related literature has been carried out by all members of the group. Particularly, Dr. Pooler and Mr. Sallett have undertaken a thorough study of the history of project management within NASA.

Various members of the group have been interviewed for local television and radio programs and by the local press, particularly at the time of the Apollo 11 mission. It is believed that this has been useful in interpreting the Apollo program to the public.

B. NASA/BUSINESS RELATIONS

The work during the six-month period under review centered on two important aspects of the transfer of technology to the commercial sector; the decision-making criteria which affect the absorption of new technology by manufacturing firms; and evaluation of the institutional organizations specifically empowered and funded to assist in the process of the transfer to commercial enterprises. The work was conducted by Professors Peter Franck, E. Bruce Fredrikson, and Eric Lawson.

1. Technology Transfer Within Manufacturing Firms

As in the previous reporting period, executives of selected corporations in Syracuse and New York proved very cooperative in allowing the staff to continue their interview program. The following background studies were completed:

(a) 6225-WP-5 "Technological Data Transfer within the Morris Machine Works Company," Staff, May, 1969.

(b) 6225-WP-6 "Technological Data Transfer Within the O. M. Edwards Co.," Staff, June, 1969.

(c) 6225-WP-7 "Transfer of Technology at Bristol Laboratories," Gerald E. Bocian, June, 1969.

In the course of the reporting period attention shifted to the breakthroughs. A case in point is the development of an acid-waste drainline by Industrial Products Division of Corning Glass Works. The factors leading to the initiation of the new product were analyzed by two senior investigators and an occasional paper on the subject was issued. Similar studies are in process dealing with technology transfer at the Air Reduction Co., specifically with the Electron-beam vacuum melting and casting process developed by the company's Temescal Division. The reason for shifting attention from the general process to the specifics of a breakthrough is to gain insight into the technical aspects of the transfer and thus to be able to better diagnose the timing of the transfer and the obstacles to successful commercialization. The study of technology transfer at the Carrier Corporation involves the analysis of several smaller innovations in the field of air-conditioning.

Contacts were initiated at a number of small firms in the Syracuse area. With the top management of these firms we have explored various aspects of the technology transfer process. These include sources of new technological information, use of library resources, receptivity to and attitude toward various types of institutionalized programs for fostering technology transfer, awareness of services offered by NASA's TU program, and availability of venture capital for technological development. These studies will continue through the 1969-1970 academic year.

2. Institutionalized Technology Transfer

We learned a great deal about the various institutional programs established to encourage the commercial adoption of engineering and scientific technology. Officials of the Small Business Administration's Technology Utilization program were interviewed in Washington, Boston, and Dallas. This program has much to recommend it. Technological problems of business, and small businesses in particular, are closely tied to problems of general management and financing. Since the SBA is able to offer service in these areas, as well as to provide sources of technological information, the program could offer a great deal of assistance to small businessmen. However, political considerations have not favored the expansion and proper funding level for this program.

We reviewed carefully various aspects of the program of the Office of State Technical Services, U.S. Department of Commerce. Reports of all state agencies were reviewed and personal contacts were established with Washington officials of the program, as well as at several state agencies. One staff member attended the Eastern Regional Technology Transfer Conference and conducted numerous discussions with attending STS delegates. Because it can potentially reach into every state, and every major industrial area, this program is potentially a prime source of encouragement of technology utilization. Particularly in those states in which field service activities have been emphasized significant results have been achieved. Unfortunately at this writing the future of the program is unclear; it should be expanded, not dropped, if the scientific knowledge developed by NASA, DOD, and AEC is to benefit small businesses throughout the country.

3. High-level Technology Transfer - The Case of Nuclear Power

The transfer of nuclear energy technology from military purposes and complete governmental ownership to civilian uses and commercial development and ownership represents a unique opportunity for study. In the first place, nuclear energy represents "high" technology, i.e., advanced scientific knowledge. Secondly, engineering requirements are substantial because of the inherent dangers of explosion and radiation. Thirdly, the technology developed by the Atomic Energy Commission was largely oriented to noncommercial objectives. Fourthly, for these and other reasons the unknowns with respect to science, engineering, and economic feasibility were quite significant at the time firms such as General Electric Company made the decision to introduce nuclear energy into the civilian market. Similarly, for a public utility to decide to build a nuclear plant involves the adoption of a new technology and the making of the relevant decisions.

Niagara Mohawk has agreed to allow us to interview their personnel who had a hand in their decision to build the Nine Mile Point plant at Oswego. In the meantime, General Electric executives in charge of atomic sales in the Syracuse area, and of all atomic sales for the U.S. located in New York, as well as a nuclear physicist in the Research and Development Division in Schenectady, were interviewed in June.

The background information on AEC's role in this matter is largely in the public record. When it has been summarized, we should have a good case illustrating how one company made a major transfer of a revolutionary technology.

4. Participation of Graduate Students

During the period under review four new graduate assistants were invited to participate in the interview and write-up work. Two were science majors, one a political science major and the fourth a business major. Two concentrated on specific cases of technology transfer, one was assigned to the review of the institutionalized transfer services of state and federal agencies, and the fourth, hired at the end of the reporting period, was assigned to work initially on documentation and bibliography. The senior

investigators emphasized the need for close cooperation with the graduate assistants, especially those coming from non-business disciplines, thus opening the way for a better interdisciplinary understanding in the program.

5. Conferences

The staff addressed the NASA fellows and the faculty seminar on work in process and highlighted some of the problems encountered in obtaining information from primary sources.

6. Visits

Several plants and laboratories of large corporations were visited during the period under review, including the corporate laboratories of Allied Chemical Co., corporate headquarters of the Carrier Co., Air Reduction Co., General Electric Co., Bristol Myers Co. Smaller firms visited will generally not be identified by name.

At the request of Mr. Raymond Crouch of the Executive Staff at Marshall Space Flight Center, one staff member visited Huntsville to advise on the possibility of increasing direct transfer from Marshall to industries in the seven-state southeastern area.

A staff member also visited the Technology Use Studies Center, Southeastern State College, Durant, Oklahoma. The record of this Center's performance indicates that, with sufficient competent personnel institutional agencies can markedly advance the transfer of technology within a non-urban region and increase economic growth.

C. CASE STUDIES

The Case Study Program's activities in the Syracuse-NASA Program fall under two heads: (1) the preparation of two large "Decisions-in-the Making" Studies (Post-Apollo and Weather Modification) and (2) experimental efforts at producing shorter cases and similar studies about significant management and policy-making aspects of NASA's world.

1. Weather Modification Decision-in-the-Making

Professor Lambright (Political Science) spent much of the second semester completing his first draft. Approximately 600 pages of the rough first draft were then shaped with the aid of the editorial assistant, into the mimeographed version. During the remaining part of the semester Professor Lambright interviewed a number of key officials and meterological experts on their reactions to the initial draft. Those interviewed included: H. Hollomon (Norman, Oklahoma), Irving Krick (Los Angeles, California), Archie Kahan (Bureau of Reclamation, Denver, Colorado), Dwight Kline and H. K. Weikmann (ESSA, Boulder, Colorado), and Earl Droessler (Albany, New York).

2. Post-Apollo Decision-in-the-Making

Professor Emmette S. Redford and Orion F. White completed the first draft of their study, minus the concluding chapter. After preliminary editing the 386 page study was reproduced and initial circulation to leading officials in NASA was begun through the office of Charles Bingman, NASA headquarters. Professor Bock is to review the draft during the summer. At the end of the report period, after consultation between Professors Redford and Bock, plans had been made for Professor Redford to spend August, 1969 based in Mr. Stevens' office interviewing principal NASA officials on their reactions to portions of his draft.

3. Short Studies

In addition to reviewing the major studies described above, Professor Bock continued consultations with faculty and graduate students of Syracuse and other universities about possible subjects for short case studies. Captain Richard Head, U.S. Air Force, an advanced graduate student at the

Maxwell School who is preparing to assume responsibility for teaching defense policy and government-science-technology courses at the Air Force Academy, worked closely with Professor Bock during the semester investigating possible dissertation topics in the NASA-AEC-Defense-aerospace fields. He was encouraged to meet with a number of NASA officials. Arrangements were also made for Captain Head to do some exploratory interviews at the Air Force Academy and at west coast non-profits and think tanks, the latter with support under the short case budget.

Additional work was done during the semester on the ICP study of U.S. decision-making on the Super-sonic Transport. This study was started last year with funds of the Inter-University Case Program, Inc. Its completion by a Maxwell alumnus David Prestemon, now based in the Coast Guard in Washington, may be aided by funds and editorial assistance and typing service under the short case part of the Syracuse-NASA Program. It is also planned to have Captain Head report on his summer research to members of the Syracuse-NASA faculty and NASA trainees.

Mr. Randolph Kucera, a political science Ph.D. dissertation candidate working under Professor Bock, was supported with NASA funds for travel in connection with his research on a captive aerospace corporation (Grumman). A by-product of Mr. Kucera's increasingly intimate connections with officials of Grumman was his aid in arranging appointments for Syracuse-NASA faculty researchers on the project manager study.

D. REGULATIONS IN SPACE

The Regulations in Space Project is presently in its final field phases in both of its major efforts.

Professor Schlusberg has, in the period since the last report, been conducting field research into problems of contract management. His study of NASA contract administration has centered on both the informal and formal adjudicative aspects of dispute resolution. (Informal procedures refer to the ongoing processes of negotiation and decision-making at the Contracting Officer's level, whereas formal procedures refer to "appellate" proceedings before such disparate agencies as the Board of Contract Appeals, the Contract Adjustment Board, the Court of Claims, and the GAO.)

Professor Schlusberg has interviewed Contracting Officers and procurement officials at four NASA centers (Marshall, MSC, KSC, and Goddard). In addition to these interviews at the Centers, he has examined a broad sample of contract files and interviewed Project Officers and representatives from the various Chief Counsels Offices. He has also conducted a series of interviews with officials of NASA contractors (ranging from such giants as Grumman and Kodak to small instrument makers with less than 50 employees) and with members of the Government Contracting Bar in Washington. He conferred with members of some of the previously mentioned appellate agencies and reviewed many of their available files and studied the published opinions of these agencies as well as the limited body of scholarly literature in the field.

Students of the College of Law are completing field research at NASA Headquarters and at Syracuse University under the supervision of the Area Project Director. When their work is finished it, as well as the work completed during the prior year's effort, will be made the basis for teaching materials to be drafted in the fall. Six memoranda have been submitted as working papers as follows:

6224-WP-1 "'Triggering' Theory as a Defense to Claim for Vibration and Sonic Boom Damage," John K. Warsaw, August, 1968.

6224-WP-2 "Liability of Contractors and Indemnification Thereof by NASA for Claims for Damages Arising Out of the Performance of NASA Contracts," John K. Warsaw, April, 1969.

6224-WP-3 "Tort Liability of the Federal Government," John K. Warsaw, April, 1969.

6224-WP-4 "Federal Authority to Investigate Aircraft Accidents," Peter Van Allen, April, 1969.

6224-WP-5 "Human Research," David Miller, April, 1969.

6224-WP-6 "The Legal Frontier in the United States Space Program," George J. Alexander, June, 1969.

The problems studied during the prior year are summarized in a paper entitled Frontiers in the United States Space Program delivered at the XIth International Colloquium on Space Law in October, 1968, by the Area Project Directors and due to be published in the SYRACUSE LAW REVIEW, in the Summer, 1969 issue. (The paper has been submitted to NASA under the contract.)

To date, the summer research has centered on problems concerning a) the statutory authority of NASA in the operation of space programs and b) legal problems related to earth resource satellites. The latter study contributed to a paper entitled Earth Resource Satellites: Clear Sensors but Foggy Law delivered by the Area Project Director at the 7th International Symposium on Space Law at Syracuse University in June of 1969 and at Sir George Williams University in Montreal in July.

The Regulations in Space Project has had a number of collateral effects of note. A seminar in space law is projected for possible inclusion in the law school curriculum as early as the next academic year. The Inter-American and Federal Bar Associations honored the University by rescheduling the 7th International Symposium on Space Law to be at Syracuse University. Chester D. Pugsley, the benefactor who established the Pugsley chair in international law at Harvard University, has provided a modest grant for seminars in space law to the College of Law. The Area Project Director has been interviewed on local television three times during the reporting period concerning the space law project or aspects of space law and once on an educational network program. Several articles about aspects of the project have appeared in local newspapers. The Area Project Director has been quoted in newspapers in the United States and in Montreal, Science News Magazine and Business Week concerning space law problems.

III. ADDITIONAL RESEARCH

A. NON-ECONOMIC CRITERIA FOR PROJECT EVALUATION

In December, 1968, the NASA program of Syracuse University was authorized to develop a rationale for the use of non-economic criteria in the evaluation of proposed satellite application projects, and to prepare a display of relevant non-economic criteria for the guidance of NASA personnel involved in screening proposed space applications projects.

Professor George Fisk, Chairman of the Marketing Department at Syracuse University was Study Director. Acting as consultants were Mr. David Curzon (Economics), E. Bruce Fredrikson (Finance), Malcolm McRae (Quantitative Methods), Miles Martin (Library Science), and Howard Taylor (Sociology). Messrs. John Donnelly, Porter Hulett and Richard Kuklis acted as Research Assistants to the project.

This study consisted of (1) an analysis of the desirability of the use of non-economic criteria; (2) a listing of criteria considered by a consulting panel to be relevant for the decision process; (3) an explanation of how increasing levels of sophistication in scaling can be applied to measure project candidates by the criteria proposed here; (4) an explanation of the dynamics of implementing the transfer of NASA developed technology through an information distribution system; (5) an examination of the display and consideration of the feasibility of implementing the proposed methodology via the demand-supply system described earlier; and (6) a set of recommendations for follow-on studies.

The following report was completed and submitted to NASA: "Non-Economic Criteria for Evaluating Satellite Application Projects," May, 1969.

B. NASA'S INTERNATIONAL OPERATIONS: THE TRACKING SYSTEM

This study is being conducted at NASA's request in conjunction with the National Academy of Public Administration (NAPA) by Mr. Neil Hollander who is presently on the staff of the Academy and is a graduate Student in Political Science at Syracuse University.

The study analyzes the actions of the Operations Support Division of the Office of International Affairs and the Office of Tracking and Data Acquisition. It is concerned with the methods used in achieving a highly reliable tracking system operating in many different political, administrative, cultural and geographic environs. Mr. Hollander's study assesses the extent to which the experience derived from the operations of tracking stations is more generally applicable to other international organizations.

Since the last reporting period, background research into NASA's files has been completed. In addition, most of the necessary interviews of personnel in the United States have been accomplished. During the report period, Mr. Hollander traveled to Baltimore, Goddard, the Jet Propulsion Laboratory and the Goldstone Tracking Station, interviewing nineteen persons, both government personnel and private contractors.

From June 17th thru July 28th, Mr. Hollander visited Australia to accomplish further interviews. While there, he visited four tracking stations, interviewing 53 people, including Australian civil servants, Ministers, tracking station employees, corporation directors, scientists, university administrators, reporters and local government officials, as well as U.S. Embassy officials.

Future visits are projected to Mexico, Madagascar and Spain. The study is now estimated to be completed by March, 1970.

C. MULTIDISCIPLINARY RESEARCH IN UNIVERSITIES: NASA'S EXPERIENCE WITH THE SUSTAINING UNIVERSITY PROGRAM

This study being conducted by William Davis, Graduate Student in Political Science, will be both a report to the Office of University Affairs and a Master's Thesis. It is intended to accomplish two purposes: (1) assess the degree to which a selected small sample of universities have engaged in, increased or expanded multidisciplinary research and teaching activity as a direct result of NASA/SUP research support; (2) identify some of the most important factors which appear to be linked to the successful accomplishment of multidisciplinary research in universities. In addition, it is expected that this study will suggest something about the ability of NASA, or other externally supporting agencies, to successfully advance multidisciplinary activity in universities.

In the report period, research at NASA Headquarters (including a file search and interviews) was completed. An interview schedule was developed for use in subsequent visits to university campuses. The schedule included a series of questions covering: the origin of the NASA/University relationship, the organization and management of research, the multidisciplinarity of research activity, characteristics of the research environment, intra-project decision-making, the identification of relevant input variables and a personal evaluation of multidisciplinary research activity.

During the reporting period, visits to three university campuses were made for the purpose of conducting interviews. From May 6th through 8th, interviews were conducted with nine university administrators and research personnel at the University of Pittsburgh. A visit to the University of California (Berkeley) from June 2nd through 6th resulted in interviews with ten university administrators and research faculty. From June 9th through 11th, interviews were conducted with ten university personnel at Washington University (St. Louis).

Future visits were planned to the University of Tennessee and Purdue University. This study is expected to be completed in October, 1969.

D. PUBLIC ADMINISTRATION, THE UNIVERSITIES, AND NASA

1. Summer Institute

In October, 1968, in cooperation with personnel at Goddard Space Flight Center, The Goddard Institute of Space Sciences of Columbia University and NASA Headquarters, Vice President John C. Honey and Professors Frank Marini and W. Henry Lambright began planning an Institute of Public Administration for Advanced Undergraduate Students for the Summer of 1969. Planning and preparation of the Institute was carried out between late October, 1968 and March 6, 1969 when Syracuse University was notified by NASA's Office of University Affairs that the Summer Institute would be unable to be carried out in 1969.

It was decided to continue with the research portion of the Institute, and Professors Lambright (Political Science-Public Administration) and Marini (Political Science-Public Administration) -- assisted by Mr. Francis McGee (Public Administration) and Mrs. Roberta Reiner (Political Science) -- have conducted research on University Public Administration Programs.

2. Research

Professor Marini and Mr. McGee have conducted research on NASA support of programs in areas related to Public Administration and Administrative Science, Multidisciplinary and team work in Universities, and the development of work related to Public Administration in Universities. The initial phase of the research involved a detailed study of the history and structure of NASA's support of programs related to Public Administration. This research necessitated visits to NASA headquarters, substantial search of documents and Mr. McGee's relocation to NASA Headquarters for the Summer. The second phase of the research (which is still underway) has involved extensive interviewing and on-site examination and document collection at selected Universities. At the close of this reporting period, interviewing was still underway. When the data collection is terminated, documents, research notes, and tape-recorded interviews will have been collected at about twenty-five Universities (it is still estimated that the interviews alone will amount to 150-200 hours of recorded interviews which average 45 minutes each in length). Beginning in October, 1969--and running simultaneously with the latter stages of data collection--the data will be analyzed for the purpose of producing a report to NASA, a dissertation by Mr. McGee

to the Maxwell School of Syracuse University, and a variety of publishable research papers. The analysis and writing will continue through the academic year 1969-1970.

Professor Lambright and an advanced graduate student, Mrs. Roberta Reiner, initiated a study of Schools of Public Affairs and Public Administration as Perceived by Other Professional Schools and The University Administration in Their Own Institutions during the summer of 1969. Professor John Honey, Vice President for Research at Syracuse, has also participated in the project.

This study is intended to explore the present state of interactions between public administration and other professional schools in terms of teaching and research and to identify the factors that tend to encourage and impede interaction. Singled out for special attention in this context is the "image" of Schools of Public Affairs and Public Administration within their own universities. These universities were contacted: Harvard, Pittsburgh, Cornell, Pennsylvania, Princeton and Syracuse. The results of interviews with university administrators and faculty will be combined with findings from a mailed questionnaire. Further campus visits will take place in the fall at the University of Southern California, University of Washington, University of California at Irvine, New York University, SUNY at Albany and perhaps others. Originally it was hoped to accomplish the necessary travel during the summer but Professors Honey and Lambright decided the study would be a much more useful one if "slowed down" so that interviews could be held during the school year when more key university officials would be available.

3. Development of Dissertation and Thesis Topics

"Multidisciplinary Research and Teaching in Public Administration in Selected Universities," Francis McGee (Public Administration). Mr. McGee will submit a dissertation for the Doctorate in Public Administration to the Maxwell Graduate School of Citizenship and Public Affairs of Syracuse University. The purpose of the dissertation is to examine the history and nature of multidisciplinary and team work in selected areas with an eye toward the peculiar opportunities and disadvantages of such work as those

most directly involved perceive them. An effort will be made to assess the ways in which NASA support and interest has impacted upon such work and the likely future directions of such work. The primary data for the dissertation will consist of the transcripts of open-ended interviews at twenty-five or so Universities which have a strong interest in work in Public Administration and similar interviews in NASA Headquarters.

IV. EDUCATIONAL ACTIVITIES

A. GRADUATE SEMINAR IN "SCIENCE, TECHNOLOGY AND PUBLIC POLICY"

Taught by Professors W. Henry Lambright and John C. Honey (Political Science), this course explored the interaction between government and science. It focused on the political activities of scientists and others concerned with science policy. Two of the central issues were the nature and extent of the nation's adaptation to scientific and technological change, and the exploration of ways to apply science and technology to the human problems of our society. The course is given every other semester as a regular part of the graduate curriculum in Political Science. During the past semester, most of the NASA Trainees were enrolled in the course.

The NASA program provided funds to strengthen the course through the addition of presentations and discussions by outside speakers. Those who appeared during the spring semester were:

Dr. Charles V. Kidd
Executive Director
Federal Council for
Science & Technology
Washington, D. C.

Dr. Harold Orlans
Governmental Studies Program
The Brookings Institution
1775 Massachusetts Ave., N.W.
Washington D. C. 20036

Mr. Theodore Heintz
Budget Bureau
Washington, D. C.

Mr. Sumner Myers
Institute of Public Administration
1250 Connecticut Ave., N.W.
Washington, D. C. 20036

B. INTERDISCIPLINARY SEMINARS

The Interdisciplinary Seminar series initiated in the Fall of 1968 continued throughout the academic year. Direction and planning of the seminar schedule were carried out by Prof. N. Schwartz (Engineering). Listed below are the presentations for the reporting period:

1. January, 1969: Prof. N. Schwartz - "Systems Analysis (Modeling and Representations that include social science variables and parameters)".
2. February, 1969: Prof. N. Schwartz - Continuation of January discussion.

3. March, 1969: Prof. D. Wilemon - "Project Management: A Structural-Functional Analysis".

4. April, 1969: Mr. J. Cicero, Prof. W. Pooler, Prof. D. Wilemon, Prof. B. Wood - "NASA Project Management". These presentations included:

   Cicero - Demographic characteristics and mobility patterns of NASA Project Managers.

   Pooler - Historical evolution of project management within NASA.

   Wilemon- Managerial behavior of NASA project managers.

   Wood - Interface of NASA's research and development organization with NASA's programmatic organization.

5. May, 1969: Prof. P. Franck - "Technology Transfer in the Large Firm".

Attendees at the seminars represented a broad cross-section of disciplines, and the forced association of (sometimes conflicting) interests was both rewarding and stimulating. The series will continue during academic year 1969/70.

C. NASA TRAINEESHIPS

Substituting in midterm for Professor Honey, Professor Bock, after consultation with Maxwell department chairmen, selected three new NASA trainees and one new trainee to fill the vacancy created by the resignation of Mr. David Puryer. Those selected for the three-year traineeship beginning July 1, 1969 or September 1, 1969 are:

Jack Needleman, City College, New York (A.B., Political Science)

Richard Schott, Stanford University (A.B., History) and Department of State

Michael Karwoski, Notre Dame University (B.S., Engineering)

Selected to fill the two-year vacancy created by Mr. Puryer's resignation:

David Fauri, Public Administration doctoral program, Maxwell School, Syracuse University

At the request of department chairmen, two traineeships will be filled during the summer period after personal interviews with all candidates. A separate report on the Traineeship Program will be submitted to NASA.

D. OTHER EDUCATIONAL ACTIVITIFS

Professor Bock began consultation with department chairmen in the Maxwell School about possibilities of course modernization (take greater account of changes resulting from science-technology) and joint graduate programs.

In Professor Bock's course on Executive Leadership and Politics, taught in June to the entire one hundred students completing the several MPA programs, an intensive student exercise was carried out involving simulation and research on decision-making on SST, Post-Apollo, and ABM. Chapters of the Redford-White study on Post-Apollo were used along with NASA films and other materials for briefing the students in that particular exercise.

V. NEW STARTS

During the report period a number of new starts were proposed by professors who had been encouraged to visit various NASA installations. Professors Onsi and Horwitz of the College of Business Administration; Ely and Fishell of the Center for Instructional Communications; and Henning, Price and Sufrin of the Maxwell School made trips and inquiries and began to develop research proposals. Several of these are still pending. The two major starts which were funded were the following:

A. EXPOSITION AND REAL TIME DECISION MAKING

This new start under the direction of Prof. G. Harry McLaughlin of the School of Journalism was funded for the Summer period to begin July 1. In the Fall semester the work will continue with funds from the School of Journalism. It is felt that this project has led to an awakening of research interest in areas which previously had not been involved, and the active encouragement engendered in the School of Journalism is reflected in their funding of the ongoing work.

B. PARTITIONING NASA INCENTIVE CONTRACTS

The new start began on June 1 under Prof. P. Bruce Berra of the Department of Industrial Engineering in the College of Engineering. The major portion of the work is to be carried out by Mr. W. Stevenson who is a graduate student doctoral candidate in the College of Business Administration. This rather novel form of interdisciplinary involvement is considered to be an interesting development and it is hoped will become a model for future relationships between colleges at Syracuse University.